

REMARKS

Claims 1-79, 82-85, 88, 91,92, 93-97 are cancelled. Claims 80, 81, 86, 87, 89-90 and 98-103 remain active and under consideration in this application.

At the outset, Applicant wishes to express his sincere gratitude that the various previous grounds of rejection and objection are indicated as withdrawn at pages 2-4 of the Official Action.

Claims 80, 81, 86, 87, 89, 90 and 98-103 stand rejected under 35 USC 103(a) as being unpatentable over Woodhouse in view of Kirk-Othmer (both previously cited).

However, neither reference, either alone or in combination with the other, would have described or suggested the claimed subject matter to one skilled in the art at the time the claimed invention was made.

There are numerous reasons for this conclusion as enumerated below.

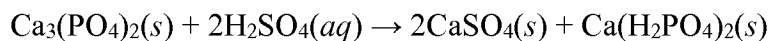
1. First, the examiner has mistakenly equated **superphosphate to phosphoric acid**. The error is found in the Determination of the Scope and Content of the Prior Art (page 5), Finding of Prima Facie Obviousness Rationale and Motivation (page 7) and Response to Arguments/Declaration under Rule 132 (page 14). In short, the examiner assumes phosphoric acid, sulfamic acid and salts and other fertilizers are mixed together in the same composition and therefore Woodhouse discloses or suggests a similar invention to that claimed. However, this is not what Woodhouse teaches.

In the claimed composition, phosphoric acid or nitric acid is essential in the stability of the nutrients. A low pH inhibits the ammoniation reaction with the acid components of the superphosphate. In Woodhouse, due to the alkaline products, the range of pH falls between 6-8, and there is no excess phosphoric acid or sulfamic acid after the neutralization reaction. Also, all the metals added from salts of sulfamate or from the phosphatic rock would be reacted into **metallic ammonium phosphates and metallic**

phosphate, i.e. compounds with low solubility in water which are sometimes used as slow release fertilizer.

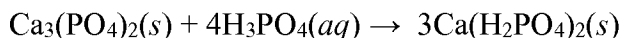
In the early 20th century, superphosphate was also **misnamed** as “acid phosphate” but no acid phosphoric results when diluted or used in soil. The commercial reactions of superphosphate and triple superphosphate and phosphoric acid and the ammoniation of superphosphate are as follows:

Superphosphate is a two product mixture derived from the reaction of rock phosphate and sulfuric acid:

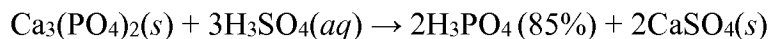


superphosphate

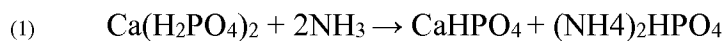
Triple superphosphate:



Orthophosphoric acid or **phosphoric acid**:



Ammoniation of Superphosphate:



2. Second, in Woodhouse, the final product used in the fertilizer composition is not a salt of sulfamic acid and similarly to Von Locquenghien, **salts of sulfamic acid are not mixed with other nutrients and/or directly applied to plants**. According to Woodhouse, there was a need for the fertilizer industry “*of adding inorganic nitrogen to superphosphate by treating the same with free or uncombined ammonia that will react with the acidic components of the superphosphate* (page 1, left side, ln 12-15).” In Harvey (US 1,948,520), **ammonia neutralizes free acid** (page 1, left side, ln 10-15). In Bruijn et al. (US 2,555,634), **ammonia is the neutralizing agent** and the **pH of the reaction mass is maintained between about 6 and 8** (column 4, line 18-21). Clearly, ammonia, from ammonium sulfamate, is to be reacted out with superphosphate, and the final fertilizer composition in Woodhouse does not, and cannot, contain any salts of sulfamic acid.

In Woodhouse, **ammonium sulfamate** is reacted out with some of the components of the superphosphate. That is, “*ammonium liquid with suitable proportions of superphosphate or mixed fertilizers containing phosphatic materials . . . and the proportions dependent upon the desired chemical composition of final product . . . compared with processes involving the separate addition of the same ingredients, a lower temperature on ammoniation of the product results* (page 2, right side, ln 25-35). Clearly, the addition of an ammonium liquor to phosphatic materials results in the production of **ammonium sulfate**.

3. Third, in Woodhouse, the “desirable” **preparation** (as taught therein) of the fertilizer requires **three** steps. First, preparing a liquor containing various proportions of sulfamic acid, ammonia and water (the “**ammonia liquor**”). Second, this liquor is then mixed [reacted] with phosphatic materials (the “**ammoniation of superphosphate**”). Third, only then the resulting product is **mixed** with additional fertilizer materials, such as potash salts and the like (page 2, left side, ln 24-36). Again, this shows that any **ammonium sulfamate is used as a reagent** in the preparation of **ammonium sulfate**.

Though Woodhouse equates sulfamic acid and its salts, including calcium and magnesium, to ammonium sulfamate or equivalent ammonium salts. That, “*the **sulfamic acid or salts thereof may be added alone (as fixed ammonia containing material)***”. (page 1, right side, ln 41-43). Woodhouse made clear that “*sulfamic acid or other salts of sulfamic acid **may be substituted** for and utilized equally as well as the ammonium sulfamate of the examples*” (page 3, left side, ln 25-29). And furthermore, Woodhouse stated that “*sulfamic acid may be **equally** as well **substituted** for its ammonium salt.*” (page 2, right side, ln 57-59).

4. Fourth, moreover, Woodhouse **never discloses or suggests**, either in the specification or in the claims, the use of **calcium or magnesium sulfamate as fertilizer** or mixture with other fertilizers, such as potassium salts. It is always the combination of sulfamic acid and/or its salts of sulfamic acid. Since Woodhouse is primarily interested in ammonium sulfamate, the use of calcium/magnesium sulfamates and sulfamic acid confirms the assessment that there is a displacement of the bivalent cations by ammonia in the sulfamate salt.

In addition, the use of **alkaline and magnesium** is well known to **maintain contaminants from precipitating out after long storage**. According to Caldwell (US 2,683,075), the addition of alkali metal salt may precipitate any fluorine component of the phosphatic salt as potassium fluosilicate (column 2, ln 22-24). According to Datin (US 2,874,036), **magnesium salt minimizes the formation of fluorapatite** (column 3, ln 23-25). In Richmond et al. (US 3,507,641), 0.10-0.50 percent by weight of **magnesium oxide is added to the slurry to further improve its suspension characteristics** (column 10, line 42-45). US 4,383,846 to Newsom teaches use of N-substituted sulfamic acids to flocculate magnesium salts from fertilizers derived from the ammoniation of phosphoric acids. The metallic carbonaceous particles are flocculated and float to the surface, leaving a clarified liquid below, free of metals, after treatment with surfactants based on N-substituted sulfamic acids.

5. Fifth, in Woodhouse, ammonium sulfamate provides a **wide range of free ammonia** (page 1, right side, ln 30-34) in contrast with other sources of ammonium, which have limited solubility in low temperatures (page 1, left side, ln 42-51). According to Woodhouse, *“it is the object of this invention to provide a means for the preparation of improved ammoniating solutions covering a **very wide range of free to fixed ammonia** (page 1, ln 52-55).”*
6. Sixth, Woodhouse states that *“sulfamic acid or its salts may be added to a phosphatic material, either before, after or during of other materials . . . (page 1, right column, ln. 41-44)”* The ammonia solution cannot contain calcium, magnesium or other bivalent metal as their cations is displaced by ammonium and the resulting bivalent metal would be reacted out by phosphates, due to the extreme low solubility of metallic phosphates. In our invention, there is a precise order each ingredient is added. Solution must be acidified to a low pH prior to the mixture of salts of sulfamate and phosphate. **This step insures that no chemical reaction occurs between salts of sulfamate and phosphate and other nutrients, including salts of potassium.** In contrast, the claimed invention contemplates the direct use of bivalent metallic sulfamate for plants.

This is confirmed in Woodhouse two examples: the first one suggests the use of ammonium sulfamate and the second one 94 parts ammonium sulfamate with urea/ammonium carbamate and ammonia. Clearly, if there is an **excess of sulfamic acid**, the **reaction of ammonium and phosphatic materials would stop** due to the extremely low pH (plus the ammonium sulfamate would be unstable).

7. Seventh, the assumption, reasoning and generalization that since sulfamate has nitrogen or sulfur and therefore sulfamate is useful as a fertilizer is often contradicted in practice. Importantly, ammonium sulfamate is a teaching away as it has been approved by the EPA as an efficient herbicide. Moreover, several of the most important bivalent metallic

sulfamates are not in the EPA's TSCA (Toxic Substances Control Act) Inventory, which show the lack of interest by the fertilizer industry and limit their testing in laboratory, greenhouse and farm. In fact, calcium sulfamate is only listed in the TSCA confidential inventory while manganese and copper sulfamates are neither listed nor approved for manufacture/importation. Additionally, a person skilled in the art cannot predict in "theory" how a molecule with N and S would work in "practice" as a plant nutrient. Further, no one can predict whether sulfamate can outperform sulfate under any particular conditions. An example of a nitrogen-containing molecule with well known phytotoxicity is biuret ((H₂N-CO-)₂NH), a byproduct in urea ((NH₂)₂CO) manufacture. To confound even those skilled in the art, the symmetry in the placement of structure in Fe EDDHA¹ causes substantial difference in efficacy. Thus, there is clearly skill in selecting and mixing all the relevant macro and micro nutrients in such a way that a perfectly balanced and complete fertilizer may be made. There are hundreds of patents spread over a period over 50 years on how to ammoniate phosphatic materials.

8. Eighth, the ammoniation of superphosphate and other methods to purify or increase the solubility of certain salts in the phosphate rock has been exhaustively patented. In Everett (US 2,885,279), liquid ammonia is used to neutralize acid materials in superphosphates. So the "*constituents phosphoric acid and **monocalcium phosphate react with ammonia to yield monoammonium phosphate and dicalcium phosphate. On further treatment with ammonia . . . monoammonium phosphate can be converted to diammonium phosphate*** (column 5, ln 25-31)." In Woohouse, all excess phosphoric acid would be reacted out by the ammonium sulfamate. The final product is either **mono and/or diamonium phosphate and ammonium sulfate**.

In Casimer and Richmond (US 3,416,910), it can be readily seen that **ammonia is used as pH neutralizer**, i.e., "*the amount of ammonia required to neutralize to a give pH varies somewhat with different shipments of phosphate rock*" (column 12, ln 41-44). In

¹ EDDHA is commonly known as ethylenediaminedi (o-hydroxyphenylacetic) acid, and is an iron-chelator.

Casimer, the desired pH was in the range of 6.0-7.5 (column 24, ln. 18-20). In Bruijin et al. (US2,555,634), the desired pH is 6-8, with use of NH_3 and SO_2 .

9. Ninth, impurities and differences in manufacturing, e.g. excess of acid as reagent, may change the pH of many commercial products. Thus, **the MSDS of these products can result in a wide range of pH depending on the manufacturing process, from slightly acidic to slightly alkaline**. For instance, a monopotassium phosphate (MKP) from one manufacturer may have a pH of 7.4 and another may have a pH of 6. Similarly, the use of an excess sulfamic acid may lower the pH of ammonium sulfamate from a neutral to basic to slightly acidic. But, under no circumstances, is it similar to a pH of a bivalent metallic sulfamate, which has a very low pH of 1.0 to 1.7 at 9% Fe, Mn, and Zn, and 6% Ca+Mg. Even when diluted to 1:250, the pH remains low at 3.4 to 4.4.
10. Tenth, it was argued previously that ammonium can displace bivalent cations. According to Casimer et al. (US 3,416,910), in a ammonium/phosphatic slurry, Cu^{+2} from chelated EDTA reacts with Ca^{+2} , releasing Cu from the chelate, which Cu^{+2} would react with NH_4^+ and PO_4^{3-} . In contrast with the highly soluble copper sulfamate, the resulting **copper ammonium phosphate has low solubility and “would not leach out of the soil as readily”** (US 3,416,910, column 8, ln. 51-58 and column 9, ln 2-8). Further, at the pH 6-8 of the superphosphate, copper ammonium phosphate would have precipitated out from solution (Since metallic EDTA has a higher stability constant than bivalent metallic sulfamate, it is even easier to displace the metal and precipitate the metal from the sulfamate with ammonium and phosphate.) No metallic sulfamate is available in the Woodhouse’s fertilizer mixture.

Similarly, according to Brown et al. (US 6,322,607), **“insoluble zinc ammonium phosphate (ZnNH_4PO_4)** may be formed in the presence of ammonium ion and phosphate ion in the granulator . . . which is not available for crops, especially in sandy neutral or alkaline soils under dry conditions,” and “when a synthetic chelate such as

ZnEDTA is mixed with phosphoric acid before ammoniation, **acid decomposition of the chelate molecule results in decreased availability of some Zn fertilizers**" (column 1, ln 55-64). (Ksp of magnesium ammonium phosphate at 25C is 3×10^{-13} and Ksp for ferrous ammonium phosphate is 1.8×10^{-11} at pH 2). No metallic sulfamate is available in the Woodhouse's fertilizer mixture.

Woodhouse involves the use of a nitrifying agent, ammonium sulfamate, which **increases the formation** of ammonium salts and ammonium phosphate salts. This first reaction step, the ammoniation of superphosphate, also results in metallic ammonium phosphate which **lowers the solubility and availability** of bivalent metallic nutrients. The ammoniation of phosphatic materials, effectively, **neutralizes excess acid**. Thus, Woodhouse adds ammonium sulfamate in the first of three steps in the fertilizer "mixture" to **increase reactions** that require ammonium-containing sulfamate rather than metallic containing sulfamate, as the addition of metals would only increase the insoluble metallic ammonium phosphate. Thus, **arguendo**, even if Woodhouse teaches a complete or improved fertilizer, as the Examiner purports, Woodhouse reference would be **teaching away** from such a chemical combination by making **by raising the pH of the fertilizer mixture, by making the release of nutrients slower and uncontrollable in foliar and fertigation or by making it less complete of essential bivalent metals, by lowering the content of bivalent metals in the molecule, either by displacement reaction or by decomposition reaction or by precipitation of bivalent metals from the sulfamate, oxide, sulfate, carbonate, nitrate, etc.**

11. Eleventh, the similarity between Von Locquenghien and Woodhouse is striking. In Von Locquenghien we have diureides of dicarboxylic acids from N-substituted sulfamate and in Woodhouse we have a metallic ammonium phosphate and metallic phosphate derivatives from the ammonium liquor. In both Von Locquenghien and Woodhouse we have products that are highly **insoluble in soil and in foliar applications** and are best used, at best, as **slow release fertilizer**. Most importantly, **neither Von Locquenghien**

nor Woodhouse proposed or intended to use fertilizers containing bivalent metallic sulfamates as ingredients for final fertilizer.

Given that the solubility of most fertilizer based in phosphate and potassium, with pH between 5-7, is around 150-200 g/l, a mixture of 1 liter of concentrated fertilizer using 100 g of monopotassium phosphate, 100 g potassium nitrate and 100 g of ammonium nitrate will result in a solution with pH between 5-7.

This slightly acidic pH would not be enough to hold any bivalent metallic sulfamate in solution for a period of five minutes or months before precipitation occurs. In fact, diluting 100 g of ammonium nitrate in 1 liter of water and then adding solution of 100 ml calcium sulfamate and magnesium sulfamates (3% Ca, 1.5% Mg) will result in white clouding of solution within minutes. Same will happen adding 100 g of either ammonium phosphate (MAP) or 100 g monopotassium phosphate (MKP) to a solution of calcium/magnesium sulfamate.

Instead, adding first 15 to 20 ml of phosphoric acid 75% to water, then the same ammonium nitrate and salts of phosphates and then the bivalent metallic sulfamates will result in a stable in solution, for months and years. No precipitation occurs.

Also, it should be pointed out that the acid dissociation constant pK_a of H_3PO_4 is 2 and $H_2PO_4^{-1}$ is 7 and sulfamic acid is 1. That is, superphosphate and other phosphate fertilizers are not strong acids, at least not enough to avoid metallic phosphate precipitation. These phosphates will not lower the pH to the point to avoid the displacement reaction, ammonium displacing the bivalent metals from sulfamate, precipitating out the bivalent metals, either with sulfates or phosphates.

Kirk-Othmer merely discloses that sulfamic acid readily forms various metal sulfamates by reaction with the metal of the respective carbonates, oxides or hydroxides.

Clearly, this disclosure alone would have failed to correct the deficiencies of Woodhouse enumerated above.

Hence, even assuming, *arguendo*, that one skilled in the art would have been motivated to combine these two cited references, the combined disclosures would not have put the claimed invention in the artisan's possession.

Finally, it is urged as unnecessary to cite the U.S. patents noted above in an Information Disclosure Statement as these U.S. patents support the patentability of the claimed invention.

Thus, this ground of rejection is unsustainable and should be withdrawn.

Claims 91 and 96 stand rejected under 35 USC 103(a) as being unpatentable over Woodhouse in view of Kirk-Othmer, ~~and further in view of Rodder et al.~~

~~However, Rodder et al. fails to correct the deficiencies noted above for Woodhouse and Kirk-Othmer.~~

However, in view of the above amendments, this ground of rejection is believed to be moot.

Accordingly, it is believed that this application is now in condition for allowance. Early notice to this effect is earnestly solicited.

Respectfully submitted,

A handwritten signature in cursive script, reading "William E. Beaumont". The signature is written in dark ink and is positioned above the printed name.

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